

PCT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year)

21 June 2001 (21.06.01)

International application No.

PCT/GB00/03194

Applicant's or agent's file reference

MRH/P15712WO

International filing date (day/month/year)

18 August 2000 (18.08.00)

Priority date (day/month/year)

18 August 1999 (18.08.99)

Applicant

THIED, Robert, Charles et al

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

14 March 2001 (14.03.01)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Olivia TEFY

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference MRH/P15712W0 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/GB 00/ 03194 | International filing date (day/month/year) 18/08/2000 | (Earliest) Priority Date (day/month/year) 18/08/1999 |
| Applicant BRITISCH NUCLEAR FUELS PLC | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☒ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

P/GB 00/03194

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 G21C19/48 C25C1/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 G21C C25C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| X | WIBERG: "Holleman-Wiberg, Lehrbuch der anorganischen Chemie, 71.-80. Auflage" 1971, WALTER DE GRUYTER & CO., BERLIN XP002151488 page 709, line 46 -page 710, line 20 --- | 1,5,7, 18,19 |
| X | US 4 880 506 A (ACKERMANN ET AL.) 14 November 1989 (1989-11-14) claims 1,7,13 --- | 1,2,4-20 |
| X | US 5 009 752 A (TOMCZUK ET AL.) 23 April 1991 (1991-04-23) claims 1,7 --- | 1,2,4-20 |
| X | US 5 650 053 A (GAY ET AL.) 22 July 1997 (1997-07-22) column 1, line 36 -column 2, line 5 --- -/-- | 1,2,4-20 |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

30 October 2000

Date of mailing of the international search report

15/11/2000

Name and mailing address of the ISA
 European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer

Thiele, N

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03194

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| X | WO 98 06106 A (BRITISH NUCLEAR FUELS PLC) 12 February 1998 (1998-02-12) claims 1,15,20-40 ---- | 1-20 |
| A | GB 2 150 740 A (ALLIED CORPORATION) 3 July 1985 (1985-07-03) claims 1-5 ---- | 1-20 |
| A | US 5 378 381 A (TAKAHASHI ET AL.) 3 January 1995 (1995-01-03) claims 1-3 ---- | 1-20 |
| A | US 3 972 787 A (NOBEL ET AL.) 3 August 1976 (1976-08-03) claim 1 ---- | 1-20 |
| P,X | WO 99 41752 A (BRITISH NUCLEAR FUELS PLC) 19 August 1999 (1999-08-19) cited in the application claims 1-33 ----- | 1-20 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/03194

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|---|---------------------|--|--|
| US 4880506 | A | 14-11-1989 | CA 1326839 A DE 3837572 A GB 2212171 A,B JP 1237497 A JP 2641533 B | 08-02-1994 18-05-1989 19-07-1989 21-09-1989 13-08-1997 |
| US 5009752 | A | 23-04-1991 | NONE | |
| US 5650053 | A | 22-07-1997 | NONE | |
| WO 9806106 | A | 12-02-1998 | AU 3703497 A CN 1226992 A EP 1008147 A ZA 9706868 A | 25-02-1998 25-08-1999 14-06-2000 01-02-1999 |
| GB 2150740 | A | 03-07-1985 | DE 3442172 A JP 61133580 A | 05-06-1985 20-06-1986 |
| US 5378381 | A | 03-01-1995 | JP 6068907 A | 11-03-1994 |
| US 3972787 | A | 03-08-1976 | CH 598364 A DE 2607306 A FR 2314271 A GB 1509865 A | 28-04-1978 23-12-1976 07-01-1977 04-05-1978 |
| WO 9941752 | A | 19-08-1999 | AU 2526799 A | 30-08-1999 |

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|---|---|--|
| Applicant's or agent's file reference AJC/P15712WO | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/GB00/03194 | International filing date (day/month/year) 18/08/2000 | Priority date (day/month/year) 18/08/1999 |
| International Patent Classification (IPC) or national classification and IPC G21C19/48 | | |
| Applicant BRITISCH NUCLEAR FUELS PLC | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

| | |
|--|--|
| Date of submission of the demand 14/03/2001 | Date of completion of this report 07.12.2001 |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465. | Authorized officer Thiele, N Telephone No. +49 89 2399 2598  |

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/03194

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*)
Description, pages:

1-12 as originally filed

Claims, No.:

1-8 as originally filed

9-19 as received on 21/11/2001 with letter of 21/11/2001

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/03194

- ☐ the description, pages:
☒ the claims, Nos.: 20
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|------------|
| Novelty (N) | Yes: | Claims | 2-6 |
| | No: | Claims | 1,7-19 |
| Inventive step (IS) | Yes: | Claims | 3,5,6 |
| | No: | Claims | 1,2,4,7-19 |
| Industrial applicability (IA) | Yes: | Claims | 1-19 |
| | No: | Claims | |

2. Citations and explanations
see separate sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

see separate sheet

CHAPTER V

1) The document cited in Chapter VI would affect novelty, if it had to be considered.

2) In the first written opinion it was mainly referred to the first four documents cited in the International Search Report, i.e.

D1: WIBERG: 'Holleman-Wiberg, Lehrbuch der anorganischen Chemie, 71.-80. Auflage' 1971, WALTER DE GRUYTER & CO., BERLIN XP002151488

D2: US-A-4 880 506 (ACKERMANN ET AL.) 14 November 1989 (1989-11-14)

D3: US-A-5 009 752 (TOMCZUK ET AL.) 23 April 1991 (1991-04-23)

D4: US-A-5 650 053 (GAY ET AL.) 22 July 1997 (1997-07-22)

The Applicant did not comment on these documents. The document cited in Chapter VI and WO-A-9806106 (D5) were not considered for the argumentation given in paragraph 2 of the first written opinion. This paragraph had the following wording:

Claim 1 is extremely broad and consequently covers essentially all known electrorefining methods, since liquid salts at any temperature or water containing a salt must be considered to be ionic liquids (see the first four documents cited in the International Search Report).

Claim 1 and claims 5, 7, 18 and 19 (now only new claim 18 remaining from original claims 18 and 19) therefore lack novelty.

3) Even if aqueous solutions were not considered to be ionic liquids, it must be pointed to the fact that liquid (molten) salts as disclosed in D2 to D4 are ionic liquids. The Applicant pointed to a definition for ionic liquids as they should be used in this application. This definition is given on page 2, lines 16 to 23. It would seem possible to introduce this definition into claim 1 to clarify the object of the invention. The fourth line of the claim could read as follows: "electrolyte comprising an ionic liquid consisting of a salt, a mixture of salts, or a mixture of components which produce a salt or a mixture of salts, which melts below or just above room temperature

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/03194

up to 100° C, applying a sufficient potential difference".
Such claim could be considered to be novel over D1 to D4.

4) Furthermore it should be considered that electrorefining methods for nuclear fuel are generally known in the art, but it would seem that those methods mostly do not use electrolytes as referred to in claims 3 and 5. Nevertheless such electrolytes are known as such (see e.g. the documents of category A cited in the International Search Report), and it is particularly it is pointed to WO-A- 9806106 (e.g. claim 15); the latter document also discloses the electrolytic separation of uranium from such liquids.

4) The industrial applicability cannot be called into question.

CHAPTER VI

WO-A-9941752 published 19.08.1999; filed 10.02.1999; priority date 11.02.1998.

9. A method according to claim 7 wherein the ionic liquid is pre-loaded with uranium ions by displacement of a metal chloride.
- 5 10. A method according to claim 9 wherein the metal chloride is AgCl or CdCl₂.
11. A method according to claim 7 wherein the ionic liquid is pre-loaded with uranium ions by destructive reduction of the electrolyte.
- 10 12. A method according to any of the preceding claims wherein purified metal is deposited at the cathode.
13. A method according to any of the preceding claims wherein the metal is deposited at the cathode as a compound.
- 15 14. A method according to any of the preceding claims wherein the composition to be separated is irradiated nuclear fuel.
15. A method according to any of the preceding claims wherein the metal to be separated is uranium and/or plutonium.
- 20 16. A method according to any of the preceding claims wherein, after use in the method, the ionic liquid is purified for further use.
- 25 17. A process for the reprocessing of spent nuclear fuel, the process including a method of any preceding claim.
18. A method according to claim 1 and substantially as herein described.

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19. Use of an ionic liquid in the electrorefining of a composition to separate a metal therefrom.

5 20. Use according to claim 19 wherein the composition is spent nuclear fuel.

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